CLAIMS

The invention claimed is:

1. A linear electrodynamic system comprising:

a housing;

a longitudinal shaft movably coupled to the housing to longitudinally and linearly reciprocate relative to the housing in the longitudinal direction of the shaft;

a stator rigidly coupled to the housing, the stator shaped to define an inner space to receive a portion of the longitudinal shaft, the stator having stator poles extending inwardly toward that portion of the longitudinal shaft received by the stator;

windings wound around the stator poles;

magnetic material affixed to a portion of each of the stator poles, the magnetic material having bore surfaces facing inward; and

a mover affixed to the shaft, the mover having bore surfaces facing outward in correspondence with the bore surfaces of the magnetic material to define a gaseous gap between each of the correspondingly positioned ones of the bore surfaces of the magnetic material and the mover, portions of the bore surfaces of the magnetic material being closer to the shaft than portions of the bore surfaces of the mover.

2. The system of claim 1 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a convex shape.

3. The system of claim 2 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has an arc shape.

4. The system of claim 1 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a V shape.

5. The system of claim 4 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a concave shape.

6. The system of claim 4 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a convex shape.

7. The system of claim 1 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a parabolic shape.

8. The system of claim 7 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a concave shape.

9. The system of claim 7 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a convex shape.

10. A linear electrodynamic system comprising:

a longitudinal shaft mounted for longitudinal and linear reciprocal movement;

a stator shaped to define an inner space to receive a portion of the longitudinal shaft, the stator having stator poles extending inwardly toward that portion of the longitudinal shaft received by the stator;

windings wound around the stator poles;

magnetic material affixed to a portion of each of the stator poles, the magnetic material having bore surfaces facing inward; and

a mover affixed to the shaft and having bore surfaces facing outward in correspondence with the bore surfaces of the magnetic material to define a gaseous gap between each of the correspondingly positioned ones of the bore surfaces of the magnetic material and the mover, portions of the bore surfaces of the magnetic material being the same distance from the shaft as portions of the bore surfaces of the mover.

11. A linear electrodynamic system comprising:

a stator defining an inner space, the stator having stator poles extending inwardly within the inner space;

a mover positioned within the inner space for longitudinal and linear reciprocal movement therein, the mover having outwardly facing surface portions positioned to correspond to the stator poles;

windings wound around the stator poles; and

magnetic material affixed to a portion of each of the stator poles and having inwardly facing surfaces positioned in correspondence with the outwardly facing surface portions of the mover to define a gaseous gap between each of the correspondingly positioned ones of the inwardly facing surfaces of the magnetic material and the outwardly facing surface portions of the mover, the magnetic material positioned on the stator poles within the inner space to permit uninhibited longitudinal and linear reciprocal movement of the mover within the inner space while limiting rotational movement of the mover more than the distance of the gaseous gap existing between the correspondingly positioned ones of the inwardly facing surfaces of the magnetic material and the outwardly facing surface portions of the mover.

12. A linear electrodynamic system comprising:

a stator with inwardly extending stator poles, the stator defining an inner space with the stator poles positioned at the inner space;

windings wound around the stator poles;

magnetic material affixed to a portion of each of the stator poles, the magnetic material having bore surfaces facing inward toward the inner space; and

a mover positioned within the inner space for longitudinal and linear reciprocal movement therein, the mover having bore surfaces facing outward in correspondence with the bore surfaces of the magnetic material to define a gaseous gap between each of the correspondingly positioned ones of the bore surfaces of the magnetic material and the mover, the bore surfaces of the magnetic material and the mover having mating non-annular shapes.

13. The system of claim 12 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a convex shape.

14. The system of claim 13 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has an arc shape.

15. The system of claim 12 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a V shape.

16. The system of claim 15 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a concave shape.

17. The system of claim 15 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a convex shape.

18. The system of claim 12 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a parabolic shape.

19. The system of claim 18 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a concave shape.

20. The system of claim 18 wherein the bore surface of each magnetic material affixed to a portion of one of the stator poles has a convex shape.

21. A method comprising:

providing a stator with inwardly extending stator poles;

shaping the stator to define an inner space with the stator poles positioned at the inner space;

winding wire around the stator poles to form stator pole windings;

affixing magnetic material with bore surfaces to a portion of each of the stator poles with bore surfaces of the magnetic material facing inward toward the inner space, the bore surfaces of the magnetic material having a non-annular shape; and

providing a mover positioned within the inner space for longitudinal and linear reciprocal movement therein, the mover having bore surfaces facing outward in correspondence with the bore surfaces of the magnetic material to define a gaseous gap between each of the correspondingly positioned ones of the bore surfaces of the magnetic material and the mover, the bore surfaces of the mover having a non-annular shape mating with the bore surfaces of the magnetic material.

22. The method of claim 21 wherein the inner space has a longitudinal axis along which the mover longitudinally and linearly reciprocates within the inner space, portions of the bore surfaces of the magnetic material being closer to the longitudinal axis of the inner space than portions of the bore surfaces of the mover.

23. The method of claim 21 wherein the inner space has a longitudinal axis along which the mover longitudinally and linearly reciprocates within the inner space, portions of the bore surfaces of the magnetic material being the same distance from the longitudinal axis of the inner space as portions of the bore surfaces of the mover.

24. The method of claim 21 wherein the magnetic material is positioned on the stator poles to permit uninhibited longitudinal and linear reciprocal movement of the mover within the inner space while being positioned on the stator poles such that rotational movement of the mover is limited to no more than the distance of the gaseous gap existing between the correspondingly positioned ones of the inwardly facing bore surfaces of the magnetic material and the outwardly facing bore surfaces of the mover.